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THE BLACKSTONE VALLEY

A STUDY IN CHOROGRAPHY IN SOUTHERN NEW ENGLAND

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INTRODUCTION

To the geographer, Southern New England offers a fascinating and challenging problem in landscape interpretation. Occupied successively by the Indians, by European agriculturists, and by manufacturers, the several cultures have left their own peculiar impressions in the landscape. Thus a confusing array of earlier and later forms, of impression set on impression is presented to the eye. Southern New England, with its long history and its several periods of development, possesses a landscape composed of a complex of relict forms, intricately involved with the more recent forms. The investigation set forth herein was limited to a strip about forty miles long and four miles wide, extending along the valley of the Blackstone River from the southern outskirts of Worcester to the northern margin of Pawtucket and Providence. Within the 178 square miles included in this purely arbitrary unit, are found represented the chief types of landscape of southern New England. Valley manufacturing towns, upland farms, wooded, rocky slopes, and many other types of less areal significance appear. It is the character and mutual relationships of these landscapes which we set ourselves to describe and interpret, not as a finished picture, but as a living, changing, developing expression of the earth's exterior.

PHYSICAL CHARACTERISTICS

The main events in the evolution of the present landforms in southern New England are already familiar to most geographers.¹

* For the drafting of the maps and charts and for assistance in the field the author is indebted to Charles Crittenden.

¹W. M. Davis, *The Physical Geography of Southern New England*. *Nat. Geogr. Soc. Monograph*, N. Y., 1896.

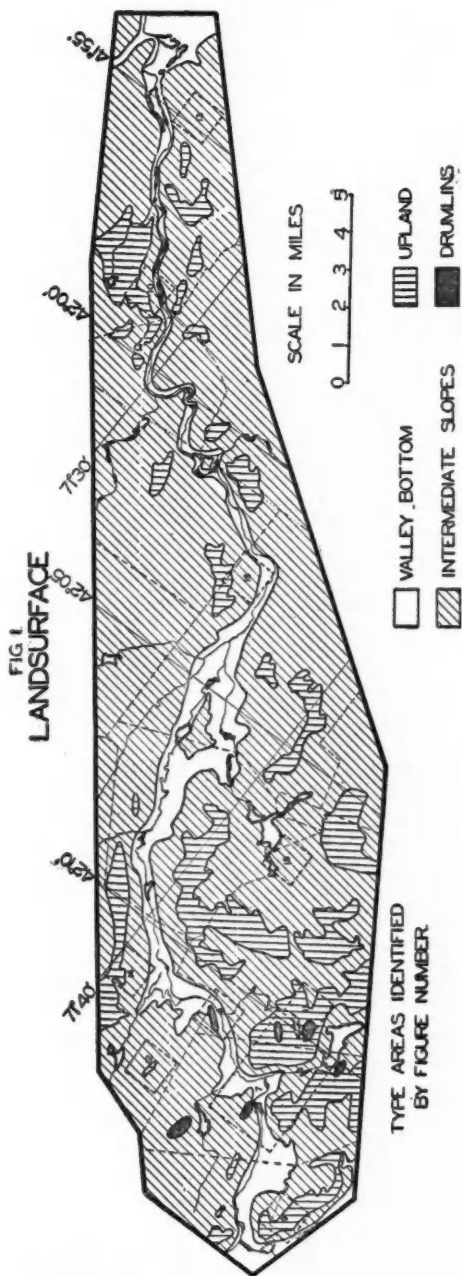
During the Cretaceous the surface of the area was reduced to a low-lying peneplain, possibly even smoothed by an invasion of the sea, so that rocks differing greatly in resistance to the forces of erosion were worn down to a nearly uniform baselevel.² On the surface of this peneplain were spread detrital sands worn from the still up-standing highlands to the north and west. With the uplift and southward tilting of the land, consequent streams began to establish their courses, flowing, in the area with which we are dealing, in a southerly direction. However, the uniform mantle of detritus which masked the varied rock structure beneath was soon cut through, and the streams were superposed on a series of rock formations, largely pre-Cambrian crystalline rocks, which varied to a marked degree in resistance. In the belts of weaker rock, broad open valleys were quickly excavated, but in the bands of more resistant strata, the valley forms remained youthful. A conspicuous amount of readjustment through shift of channel and through piracy followed, so that the present irregular drainage lines vary to a large degree from the courses of the earlier consequents, and the surface forms are characterized by valleys of irregular width, by water gaps, and by abandoned drainage lines. The original peneplain surface appears in the strikingly level sky line of New England; it is found in the area we are studying in the many irregular patches of graded upland which have not yet been dissected by the tributary streams, and which lie between 400 and 600 feet above sea level. (Fig. 1.)

The Blackstone Valley.—The present course of the Blackstone River results from two notable captures.³ The first took place between Woonsocket and Millville. (See Fig. 3 for places mentioned in the text.) A small tributary of the Pawtucket River was finding relatively easy cutting along the strike of a weak phyllite member of the Westboro quartzite, with its outlet in the low-lying carboniferous depression of the Narragansett Bay.⁴ Aided by these advantages, this river succeeded in cutting headward across the resistant Milford granite and the Bellingham conglomerate, and in capturing the ancestor of the present Blackstone a little west of Millville. The original channel of this river led southward through Ironstone toward the sea.

²W. C. Alden, *The Physical Features of Central Massachusetts*. Bulletin 760-B, U. S. Geol. Survey, 1924, p. 15 ff.

³Ibid, p. 20.

⁴B. K. Emerson, *Geology of Massachusetts and Rhode Island*. Bulletin 597, U. S. Geological Survey, 1917, p. 26.



The second capture, aided no doubt by the first one, took place near Worcester, as a tributary stream cut across the resistant outcrops of schist at Millbury, and the ridge of quartzite south and east of Worcester to divert the headwaters of the present French River. The whole Worcester depression, excavated in a belt of weaker rock, was transferred to Blackstone drainage, the divide being shifted to a point between Auburn and Oxford.

In this way the present Blackstone Valley, in the northwest corner of the map (Fig. 1), is a broad lowland excavated in weak rock. At Quinsigamond Village there is a narrow water gap. Weaker rocks immediately southeast result in a wider stretch, but at Millbury resistant layers force the river to pass over a succession of rapids where water power is abundant. Below Farnumsville the valley gradually broadens to its widest point near Uxbridge. Then a sharp bend to the southeast at Millville leads to the narrow irregularly winding trench incised in the resistant formations around Woonsocket, where again water power is available through falls and rapids. Below Woonsocket in Rhode Island, the deep gorge of the lower Blackstone results from the excavation of a weaker rock between stronger material on either side, which continues to retard the process of valley widening. In the southeastern corner of the map the Blackstone Valley loses its identity in the broad Narragansett Lowland.

Glacial Forms.—The major features of drainage and ridge lines were established before the Glacial period, but the ice modified in an important way the forms of the surface. The more prominent hills were scraped bare of soil and their southern sides were steepened. The valleys were broadened and polished. But still more important in this area, a thin veneer of glacial drift and outwash was strewn over the surface. Low hills of gravel, marshy hollows filled with a confusion of round boulders, lakes, the bottoms and shores of which are paved with rocks, soil in which the plow encounters in every furrow stones too big to move, a thin covering of coarse sand or gravel barely concealing the ribs of crystalline bed rock below, such is the heritage of the ice age. A few conspicuous drumlins in the neighborhood of Millbury and Sutton dominate the landscape. In the valley, the torrential waters from the melting ice left an aggraded floor of sand and gravel roughly stratified, and now remaining as a broad terrace on either side of the river channel. The present channel is

slightly degraded in harmony with the gradual erosion of the resistant rock sills lower in the course of the river.⁵

Climate.—The climate of this area is as unfriendly as its surface. Providence, close to the sea, enjoys relatively mild winters, but inland the severity of the cold waves and the depth of the snow increases. The average January temperature⁶ at Providence is 27.2°F and at Worcester, 24.8°. July in Providence averages 73.4°, and in Worcester 71.4°. The growing season is approximately 160 days.⁷ The rainfall is very nearly the same throughout the area, the stations recording for the most part averages between 40 and 45 inches, and with a conspicuously uniform distribution throughout the year.⁸ During the years 1841-1920, during which time Worcester has received on the average 43.7 inches of rainfall a year, the lowest amount received was 30.9 in 1914, and the highest 61.8 in 1852 (61.7 in 1888).⁹ Applying the symbols of Köppen's classification,¹⁰ Providence is on the poleward margin of the Cfa climate, and Worcester has a Dfb climate. Most of the area of this study probably falls within the climate expressed by the symbol Dfa. Cyclonic storms crossing New England, or passing near it at short intervals especially in winter, provide the rapid non-periodic variations of weather for which this part of the world is justly famous.

Forest.—The whole area was originally covered with a dense virgin forest of the oak-hickory association.¹¹ In certain of the glacial lake beds of New England and along the valley bottoms of the larger rivers, the first settlers found grassy meadow lands without brush cover and shaded only by scattered, graceful elms—a landscape of great beauty to which was given the name *intervale*.¹² It is possible that a small *intervale* of this type may have existed in the broad part of the Blackstone Valley near Uxbridge;

⁵W. C. Alden, Op. Cit., p. 56.

⁶From *Summary of Climatological Data by Sections*, Sec. 105, U. S. Weather Bureau.

⁷Atlas of American Agriculture, Part II, Climate, Sec. 1, *Frost and Growing Season*. Washington, 1920.

⁸X. H. Goodnough, Rainfall in New England. *Journ. N. Eng. Water Works Ass.*, Vol. 40, pp. 178-247.

⁹U. S. Weather Bureau, Op. Cit.

¹⁰W. Köppen, *Die Klimate der Erde*. Leipzig, 1923.

¹¹W. Lincoln, and C. C. Baldwin, History of the County of Worcester.

The Worcester Magazine and Historical Journal, Vols. 1 and 2, Worcester, 1826, p. 86.

¹²Ibid, p. 129.

but elsewhere in the narrower portions and on the slopes of the upland, and probably even on the drumlins, a dense forest sheltered the wild game on which the first inhabitants depended for their existence.

THE DEVELOPMENT OF THE LANDSCAPES

Into this not too hospitable land came man, and with man came those modifications of the original terrain which it is our special task to analyze. Three distinct periods in the modification of the original terrain can be discerned. First the native Indians with their primitive methods of land occupation created landscape forms characteristic of their culture. Then came the European settlers, first interested in farming, and these people developed out of the earlier landscape, largely obliterating it, a new set of forms reflecting a more advanced agricultural economy. Finally, industrial cities with an entirely new set of cultural forms were imposed upon the rural landscape, not by any means obliterating it, but rather forming patches scattered especially in the valley, and forming vivid contrasts with the earlier landscapes in which they are embedded.

Landscape Modifications Resulting from the Indian Culture.—The Nipmuck Indians, inhabiting the area of the Blackstone Valley, were hunters and primitive cultivators.¹³ As was common throughout New England, the permanent, stockaded villages were located either on a knoll of higher ground in the midst of a swamp, or on the flattish tops of the hills whence could be had a commanding view in all directions.¹⁴ Pakachoag Hill, just south of Worcester, is said to have been the site of one of these villages and another was situated at Grafton. Occupying an area of only three or four acres, the wigwams were arranged around the edge of a clearing, the center of which was left open for games and ceremonies. The wigwams themselves were constructed of poles bent together, and fastened at the top and covered with mats or bark.¹⁵ Villages were crowded into a small space and became very dirty in course of time so that the natives suffered severely from various diseases.

¹³J. C. Crane, *The Nipmucks and Their Country*. Worcester Society of Antiquities, 1897.

¹⁴G. W. Ellis and J. E. Morris, *King Philip's War*. New York, 1906, p. 12.

¹⁵L. B. Chase, *Early Indian Trails Through Tantiusque*. Quinabaug Historical Soc. Leaflets, Vol. 1, p. 78.

Although agriculture was carried on in clearings usually on the upland remnants where the soil is a little less stony, the occupation of the land was distinctly temporary. Land was cleared, used for a time for the cultivation of such crops as Indian corn, squash, pumpkins, or beans,¹⁶ and then abandoned in favor of a new clearing elsewhere. The villages, too, were shifted frequently in this typical form of migratory agriculture. Thus much of the flatter portions of the uplands and hill-tops were cleared and later permitted to grow up in a tangle of brush.

To supplement the products of the soil, the Indians depended on the abundant fish of the rivers and lakes and on the larger game of the forests. Temporary villages were established every summer, particularly during spawning time, at the outlets of the lakes, or at the falls on the rivers.¹⁷ The site at the outlet of Singleterry Pond near Millbury (Fig. 7) was a frequent camping place for the Indians, for this place in addition to offering the advantages of fishing in the pond, was also located near an outcrop of steatite or soapstone which the Indians used in the manufacture of utensils of many sorts.¹⁸ The signs of similar temporary villages are to be found at such points throughout the area.

Trails connected the various parts of the country, and travel over these trails was important although there was probably little exchange of products. Two east-west trails crossed the area we are discussing.¹⁹ The more important one led from the vicinity of Boston to the Connecticut Valley. It passed Grafton, and crossing the Blackstone through the site of Millbury, climbed to the upland to the west through the valley of Singleterry Brook (Fig. 3).²⁰ A second one led westward from Mendon, across the valley near Whitinsville, and westward along the southern shores of Whitins Pond. Following the lines of least resistance across the country, these trails were the precursors of the later

¹⁶G. K. Dresser, *The Indians of This Locality*. Op. Cit., pp. 108-109.

¹⁷Ibid. p. 111. Also L. B. Chase, Op. Cit., p. 73.

¹⁸*Centennial History of the Town of Millbury, Massachusetts*. Millbury, 1915, p. 27.

¹⁹L. B. Chase, Op. Cit., pp. 69-84.

Also: L. B. Chase, *Interpretation of Woodward's and Saffery's Map of 1642, or the Earliest Bay Path*. *Quinabaug Hist. Soc. Leaflets*, Vol. 1, pp. 85-98, with map.

²⁰L. B. Chase, *The Bay Path and Along the Way*. Boston, 1919, pp. 185 and 191.

roads, although the railroads, making use of deep cuts, have found somewhat different routes westward.

The Rural Landscape of the European Settlers.—Not until after King Philip's War (1675), did the frontier of European settlement reach and cross the Blackstone. As early as 1635 a band of English colonists had crossed our area en route for the Connecticut Valley, probably following the Indian trail through Grafton and Millbury.²¹ When the Indian wars broke out, Mendon, at the time the outpost of the English settlements, was the first town to be destroyed. Mendon is located just east of our area. As soon as the country had been cleared of hostile Indians, however, the English began to occupy and cross the Blackstone Valley, settling Worcester for the first time in 1685.²²

On the outer fringe of the westward expanding settlements were scattered clearings, isolated from the main area of established farms by as yet uncleared wilderness. Simple cabins of rough-hewn logs, with chimneys of mud and roofs of thatch, formed the homes of the pioneers.²³ In many cases the first crops of corn grew among the tree stumps, on land only partially cleared, or recently burned over. With the enormous labor of clearing off the virgin forest before them, and with an over-abundance of wood on every side, fire was frequently resorted to as the cheapest and quickest method of preparing the area for the raising of crops or the pasturing of animals. The hilly country in the neighborhood of the present Douglas was repeatedly burned over in the spring by settlers from the eastern side of the valley in order to keep it covered with grass for their cattle;²⁴ for in that climate, a clearing which is abandoned speedily grows up with brush as a first step in the return to a forest cover. But difficulties meant little to these people. With remarkable rapidity, the landscape was radically transformed. From a virgin forest with scattered clearings, appeared open fields, waving with corn or grain, or dotted with cattle and sheep, interspersed with scattered patches of relict woodland. Even the areas of poorer soils, and all but the rougher slopes were thus placed in use. Only twenty or thirty

²¹L. B. Chase, *Early Indian Trails Through Tantiisque*. Op. Cit., p. 81.

Also W. Lincoln, and C. C. Baldwin, *History of the County of Worcester*. Op. Cit., p. 113.

²²W. Lincoln, and C. C. Baldwin, Op. Cit., pp. 164 and 193.

²³G. W. Ellis, and J. E. Morris, *King Philip's War*. Op. Cit., p. 6.

²⁴W. A. Emerson, *History of the Town of Douglas, Massachusetts*. Boston, 1879, pp. 17-18.

years after the first fringe of settlement had invaded this territory,²⁵ the isolated clearings with the rude log cabins had become things of the past. In 1715, two-story houses, built of clapboards and with gambrel roofs had supplanted the cruder house forms, although at this time a few of the log cabins are described standing side by side with the more pretentious homes, reminders of the rapidity of the course of settlement.²⁶

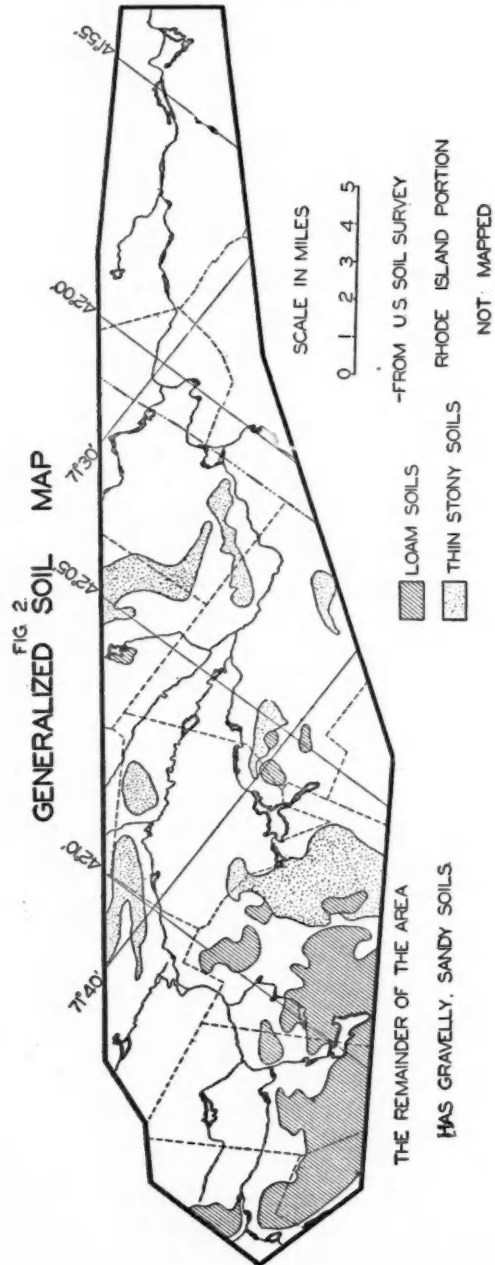
Agriculture.—During this period the labor expended in agriculture was enormous. Not only did the forest have to be cleared and the stumps removed, but also the boulders and stones in the soil had to be pulled out. With these were constructed the famous stone walls which form so characteristic a part of New England landscape. The height and width of the walls reflected the amount of stone encountered in the fields, as the care with which the rounded boulders were fitted together reflected the perseverance of the people. Fields were set off in irregular patterns, conforming somewhat to the surface, but showing nothing of the right angle regularity of the fields in the Middle West. In sections where land was devoted to the raising of hay or grain, fields were set off which could be mowed by one or two workers with scythes in a single day. With the introduction of machinery about 1850 or 1860,²⁷ the small size of these fields, and the immobility of the stone walls which bounded them became distinct handicaps.

In addition to clearing the land of forest and boulders, the early settlers constructed in some cases local systems of irrigation. Brooks were dammed, and small glacial marshes converted into little reservoirs. Canals, in some cases carefully lined with stone flags, carried the water to the fields of hay or grain, where yields were apparently sufficiently increased to stimulate a spread of similar systems. On one old farm which was studied, canals wind like contours around many of the morainic hills, and cross lower areas on small stone lined aqueducts, all of which must have required many years of patient work for construction. The irrigation system was used until 1880, when the farm was abandoned. At the present time irrigation ditches, excepting the better ones, are only faintly to be discerned.

²⁵W. Lincoln, and C. C. Baldwin, *Op. Cit.*, p. 193ff.

²⁶W. B. Weedon, *Economic and Social History of New England*. Boston, 1891, p. 283.

²⁷Yearbook, U. S. Dept. of Agriculture, 1924, Article on Hay, p. 298.



Rural Hamlets.—In the midst of the better agricultural areas, small rural villages or hamlets appeared. Sutton, Uxbridge, Grafton and Douglas were among those incorporated early in the 18th century. With few exceptions, such as Uxbridge, these towns were on the uplands, and the most prosperous of them were in areas of loam soil (Fig. 2). A group of farm homes stringing out along the highways, a store at the four corners, a blacksmith shop, and, most important of all, a white painted church with its tall steeple: such is the aspect of these "hill towns." The church steeple in its conspicuous position on the upland, is a landmark for miles around. Before the development of the manufacturing cities of the valley, these rural communities were of dominant importance. Their function was as much religious and political as it was commercial, for the town meeting to the New England colonist was an affair of the greatest importance, and every Sunday families for miles around gathered in the little meeting house for worship. While Uxbridge and Douglas have changed their form with the advent of manufacturing, Grafton, and especially Sutton remain virtually unchanged, declining with the decline of the functions for which they existed.

The Decline of Agriculture.—Agriculture in this area was never easy. As the little soil fertility was depleted, and as the more productive plains west of the Appalachians were occupied, the old New England rural economy gradually crumbled. Emigration, first to the new areas of the west, and later to the nearby cities, took from each generation its most ambitious sons. Gradually the fields which had been reclaimed from the wilderness at such a cost in human labor, and in so short a time, were allowed to revert to brush. Old farms—the ancestral homes of the present generations of city dwellers—were abandoned and fell slowly into picturesque ruin. There is probably less cleared land today in the area of this study than in the opening years of the last century.²⁸ Hidden in the scrubby woods which cover much of the terrain today, crumbling stone walls alone tell of the period when the land was cleared and cultivated.

The Growth of the Urban Landscape.—The combination of superposed rivers in the process of readjustment to underlying structure of varying resistance, and the minor damming and shift-

²⁸R. M. Harper, Changes in the Forest Area of New England in Three Centuries. *Journ. of Forestry*, Vol. 16, 1918, pp. 442-462.

Also note in the *Geogr. Rev.*, Vol. 7, 1919, p. 50.

ing of drainage lines resulting from glaciation gave New England a multitude of small water power sites. At the same time, a uniform rainfall and a run-off regulated by many lakes and marshes, insured for these sites an even flow of water. During the period of agricultural predominance, many small power sites were used for grist mills which were established to take care of the local grain production. In the urban growth which came later at these same sites, the old grist mills of the Blackstone have almost entirely disappeared, although town records, and the stories of old timers still tell of their existence.

The first successful cotton mill in America was established by Samuel Slater in 1790 at Pawtucket.²⁹ The plans which Slater had memorized in England, united with the capital accumulated by the New England traders in such cities as Providence, was a dynamic combination. By 1800 there were twenty-nine other cotton mills in the neighborhood of Pawtucket. Water power sites were at a premium: textile factories were built at Woonsocket, Blackstone, Millville, Uxbridge, Millbury, and soon each little power site was the nucleus of a new and thriving landscape formation. The rumble of the water wheel and the clatter of the shuttle filled the valley with strange new sounds, ominous for the hard-working farmers of the upland. The urban landscape had come to stay, and in it the hard-pressed agriculturists one after another sought a decent living.³⁰ Occupying but a relatively small part of the country's area, the manufacturing cities soon collected the greater part of the population, and by far the greater part of the wealth. The hard life of the farm with its characteristic lack of material comforts, and the relatively easy and prosperous life of the city is perhaps nowhere more strikingly set in contrast than in Southern New England where the older rural landscape remains to this day on the sheltering upland looking out over the bustling activity of valley manufacturing towns.

Communications: The Canal.—During the agricultural period communication was by means of wagons drawn by horses or oxen over roads; and one of the characteristics of the rural landscape today is the absence in it of railroads and in most cases of paved roads. The development of manufacturing towns, however, created an insistent demand for some more efficient means of

²⁹M. Keir, *Manufacturing Industries in America*. N. Y., 1920, p. 145.

³⁰J. T. Adams, *New England in the Republic, 1776-1850*. Boston, 1926, pp. 110-118.

transportation, especially since most of the raw materials had to be brought in from Providence, and most of the finished products sent out that way. Unfortunately the need for easier communications came just a little before the beginning of railroad development with the result that the first connection with the sea was through a canal.

The Blackstone Canal³¹ was started in 1824 and completed in 1828. Starting at Providence, it ran up the Blackstone Valley, on the west of the river below Farnumsville, and on the east above that city as far as Worcester. The canal was 45 miles long, and in that distance fell 451 feet through a number of locks. The Blackstone was never a large river: at best the supply of water was small, and by this time the mills along the stream were jealously guarding their water rights. In order to fill the canal and its locks, therefore, a number of the ponds in the neighboring uplands were dammed and turned into reservoirs in which the waters from the melting snow of spring could be saved for the low water period of the summer. This had the very desirable result not only of providing enough water for the canal but also of further regulating the flow of water for the mills in guarding against both droughts and floods.

The canal gave a tremendous impetus to the growth of the urban landscape. Along its banks many new mills were located. In the town of Millbury, for example, at least a thousand new inhabitants came to live permanently in 1830. This was a boom period: a dynamic period when growth and change were rapid, continuous, and healthy. Many of the mills of this period produced cotton textiles, but on the other hand the valley was not by any means exclusively a textile valley. From the very start its manufactures included a widely diversified list.³² In addition to the grist mills and linseed oil presses, there were makers of agricultural tools, iron foundries, and establishments for the manufacture of nails and wire. At an early date there was a rubber mill making use of raw rubber from the tropics which was being landed at Providence.³³ In response to the demand for textile machinery,

³¹*Centennial History of the Town of Millbury*. Op. Cit., pp. 110-118.

³²P. Whitney in his *History of Worcester County*, Worcester, 1793, enumerates the following industries in Millbury: a paper mill, a linseed oil mill, ten grist mills, 6 saw mills, 3 fulling mills, 7 trip hammers, 5 scythe and ax makers, 1 hoe maker, several nail factories, and 6 potash factories. Quoted in *Centennial History of the Town of Millbury*. Op. Cit., p. 82.

³³M. Keir, Op. Cit., p. 63.

factories specializing in this type of product were established at Whitinsville. Pawtucket, in 1925, had 228 different mills manufacturing 66 different kinds of products.³⁴ There were and are many baskets for the industrial eggs in each of the larger urban communities.

Railroads.—For several reasons the canal did not prosper. The rapid growth of industry dependent on water power was overtaxing the low water resources of the river, and the mill-owners, especially those in Rhode Island where the canal was not so vital a factor in their prosperity, waged bitter warfare against the diversion of water.³⁵ Then again, in times of very low water, the portions of the canal which made use of the main stream were not navigable, and the whole route was closed four or five months out of the year by ice. A railroad project, not by any means the first in the vicinity, was surveyed, and in 1847 the Providence and Worcester railroad began operation. The canal survived this competition only one year, and ceased business in 1848. It can be seen in a few places today, its tow path overgrown with bushes, its channel clogged with vegetation. Railroads now provide ample connection not only down-valley to Providence, but also eastward and westward, through Worcester or Woonsocket, with the larger markets and sources of raw material. The predominant position of Worcester as a commercial and manufacturing center is due among other things to its position on the main line of east-west transportation, and with its right angle connection to Providence through the Blackstone.

The Changing Character of Manufactures.—As long as the power for the use of the factories was derived directly from the flow of the stream, there was a tendency for small isolated manufacturing communities to spring up wherever the combination of power site and outside connection was favorable. About 1840, however, steam began gradually to supplant water power. Since coal arrived in those days chiefly by water, the cities near the coast had a distinct advantage over those farther inland.³⁶ However an urban community is not easily shifted. The early start of the up-valley industries, aided by the construction of railroads to the coal supply and to the coast was able to maintain and continue

³⁴Pawtucket Chamber of Commerce figures.

³⁵*Centennial History of the Town of Millbury*, Loc. Cit., pp. 117-118.

³⁶M. Keir, *Some Influences of the Sea Upon the Industries of New England*. *Geog. Rev.*, Vol. 5, 1918, p. 403.

the development of the interior cities. It is interesting to speculate on what might have happened if before the development of manufacturing had begun, the use of steam had been perfected. At any rate, at the present time, the water of the river is utilized largely for the boilers of the steam plants. Recently electric power sent over transmission lines from the Connecticut Valley has reached the Blackstone and is becoming of increasing importance in the power resources of our area. The tall steel towers of the power lines, set in clearings through the brush and woodland, or marching imperiously across open fields, are among the arresting features of the modern landscape which tell of the dominance of industrial life, and of the many intricate connections of that life with the outside world.

Not all the manufacturing enterprises were successful in the Blackstone area. Many of the factories built for the spinning of cotton, turned later to a variety of other products. Many factory buildings were later abandoned and allowed to fall into ruin alongside the more prosperous successful mills. In the days when factories were built of wood, or of brick walls with wooden interiors, and when fire-fighting was a social event, the records of destruction by fire are very numerous. In Millbury one plant which burned during the winter season was completely destroyed before the arrival of the fire engine, drawn by oxen. Another company lost three mills on the same site in twelve years.³⁷ There are records of periods of prosperity and periods of depression, of successes and failures. Time and again industries were saved by clever inventions, or by the business sagacity of the owners.

For a number of reasons which have been extensively treated elsewhere,³⁸ the Civil War brought about a tendency in New England for the shift from cotton textiles to the manufacturing of worsteds. This tendency was especially marked in the smaller towns of the Blackstone Valley, where none of the cotton factories had achieved as outstanding importance as those elsewhere. The lesser mills, none too prosperous in cotton, turned eagerly to the new worsted industry.

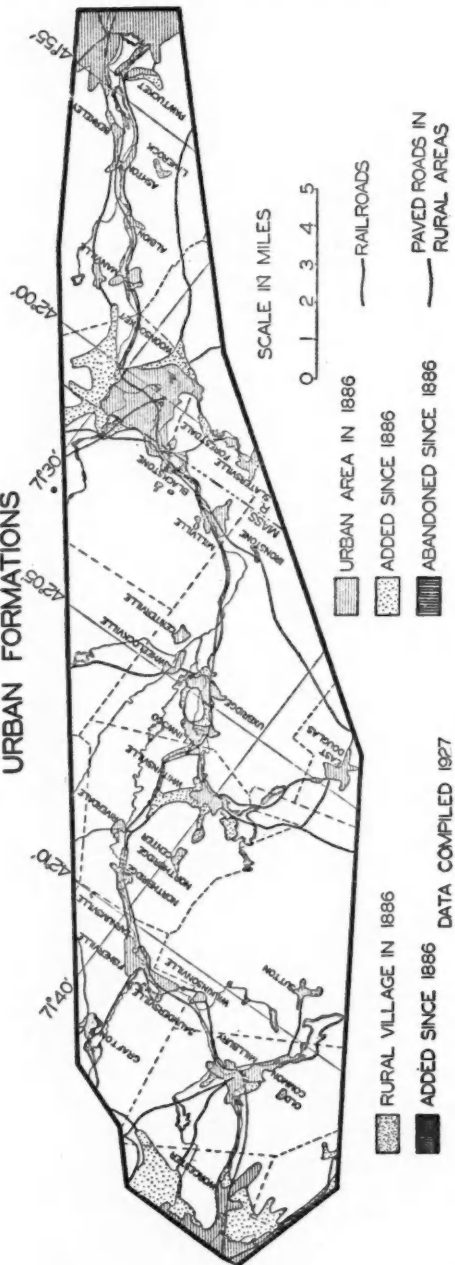
The Present Condition of the Landscapes.—The landscapes assumed approximately their present condition many years ago.

³⁷*Centennial History of the Town of Millbury*. Op. Cit., p. 131.

³⁸*The New England Economic Situation*. *Harvard Undergraduate Economic Studies*, N. Y., 1927.

Also: M. Keir, *Manufacturing Industries*, Loc. Cit.

FIG. 3.
URBAN FORMATIONS



We have already shown that the amount of land cleared and under cultivation or pastured probably began to decline about the middle of the last century in the particular area we are studying. Figures for Massachusetts as a whole show an increase of forested area beginning about 1850 or 1860.³⁹ Since then much of the formerly cleared land has been allowed to grow up in brush, pine, or hardwoods. Over much of the territory, the second growth of pine has been cleared away as a result of the increasing demand for lumber for packing cases, and for firewood.

The map (Fig. 3) shows the changes in urban area since 1886, when the U. S. Geological Survey Topographic Map of this area was made. Of the cities, Worcester, Whitinsville, and Woonsocket are the only ones to show any marked increase of area; but Pawtucket, although it shows no change of outline in the area of our study, has grown in other directions. Millbury, Northbridge, Uxbridge, Blackstone, and some of the towns along the lower Blackstone in Rhode Island show insignificant gains. The rest of the urban areas remain the same excepting for Ironstone, which no longer exists as a town. Of the rural villages, only Grafton shows a slight increase of area. In other words, in the course of some forty years, the landscape has remained in an apparently static condition excepting around the margins of the larger cities, where at the present time limited suburban residential subdivisions held by real estate companies are in evidence. But static landscapes of long duration, especially in the new world, and probably in most of the old one, must be rare. "Change is the essence of nature," is a commonplace saying. Even while the areal relations of the landscapes of the Blackstone have remained largely unchanged for forty years, the small changes are of great significance as presaging greater ones to follow; and certain modifications of the character of the landscape show that the apparently static condition is actually only a temporary phase of development.

Changes in the Urban Landscape.—There is a distinct tendency, similar to developments in other regions, for the smaller communities to decline while the larger communities continue to grow. At Ironstone an abandoned factory—a great hollow brick frame with broken windows, surrounded by a group of workingmen's cottages—forms a picturesque ruin, a symbol of the change which is less noticeable but just as real elsewhere. In the summer

³⁹Note in the *Geogr. Rev.*, Vol. 7, 1919, p. 50.

of 1927, Manchaug, lying a little west of the western margin of the area, offered its mill and mill properties at auction. Wilkinsonville shortly after the hectic war days when it manufactured khaki cloth, closed its factory, and its inhabitants now seek work in neighboring towns, some even in Worcester. There are closed factories in many of the other towns, especially textile mills, for textiles, whether cotton or woolen, are on the decline in this area. Evidences of this decline are visible on every side in the smaller towns. Meanwhile in the larger cities, where opportunities for employment are more varied, where the modern necessary luxuries are to be had at less cost, where labor is more plentiful, and where for many other reasons, mankind in the industrial areas of the world is tending to concentrate, a steady and solid growth is taking place.

Changes in the Rural Landscape.—The development of the urban landscape in the bosom of the earlier one has had certain important reflections in the surrounding country. The growing network of transmission lines is one of these changes. Another significant change is the increase of concrete roads connecting the cities and towns. To be sure these roads (Fig. 3) are chiefly in the valley, and the upland roads are prevailingly of gravel, narrow, and winding. But a few concrete roads cross the upland, as for example from Whitinsville to East Douglas, or eastward from Uxbridge, or from Millbury to Sutton. There is an increasing use of motor trucks in moving the raw material and the finished product from the more isolated mills to the markets, or to such commercial centers as Worcester, Providence, and even Boston. For such short hauls, the railroads can scarcely compete with motor trucks. The concrete roads are obviously related to the city landscape.

A more essentially rural change is the use of farming land for vegetable and fruit raising. Although vegetables and apples are raised in small quantities on almost all of the farms to supplement the income from dairy cattle, only a few large scale vegetable and fruit farms are to be found in the area. There is a distinct tendency throughout this section of New England, which has gained momentum in recent years, to plant apple orchards, especially on the hill slopes where air drainage is good. The ready market for fruit and vegetables in the nearby cities should stimulate this development. In the analysis of the landscapes which follows, representative farms of this sort will be described at greater length.

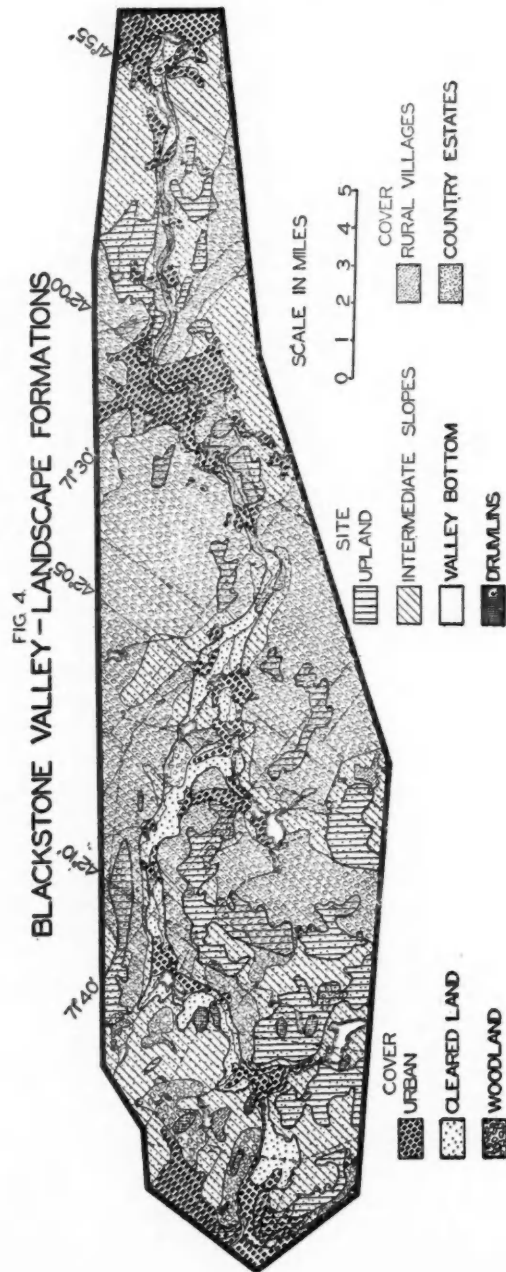
THE ANALYSIS OF THE LANDSCAPES

The foregoing sections lay the basis for the description and interpretation of the "areal scene," which is the objective of chorographic investigation.⁴⁰ This involves the synthesis of the distribution of the landscape forms, that is the recognition of the characteristic associations of these forms which create the varying expressions of the face of the earth. For such a combination of forms, we suggest the term *landscape formation*. A formation, thus defined, is a landscape composed dominantly of a definite set of cover forms (vegetation, crops, buildings, etc.), coinciding in area with a definite combination of the elements of site (landforms, soils, etc.).

Synthesis, however, unsupported by analysis is weak. A geographer trained in field investigation can usually recognize and describe the outstanding formations of a region by reconnaissance. More detailed mapping and analysis, at least in representative sections, is necessary in order that the formations may be defined in quantitative terms. In the present stage of geographic field technique it is no longer necessary that such a concept as the landscape formation should remain a matter of individual impression. Its identity can be objectively established: it can be defined in terms of percentage of a site occupied by the different forms of the cover. Several such analyses will be attempted in the paragraphs which follow.

In the area of the Blackstone Valley several landscape formations were recognized and mapped (Fig. 4). Analyzing these formations, we see that they are composed of four characteristic sites, associated in various ways with five different combinations of the forms of cover. The sites are: (1) the valley bottom, composed of flood plain and terrace lands, with sandy or gravelly soils and with extensive marshy areas; (2) the intermediate slopes, the surfaces above the valley bottoms which have been eroded below the peneplain level, characterized by steep slopes with thin stony soils and many outcrops of grayish bedrock, and with numerous short brooks which disappear now in boulder-strewn marshes and now reappear to race noisily down the steeper inclines or to pour over the rock ledges; (3) the upland, mostly remnants of the peneplain smoothed by the ice sheets and covered in many places, but not throughout, by the loam soils, relatively free from

⁴⁰For an elaboration of this view-point, see C. O. Sauer, *The Morphology of Landscape*, *Univ. Calif. Publ. Geogr.*, Vol. 2, No. 2, October, 1925.



stones, which make some of the best farmland soils in New England;⁴¹ and (4) the drumlins, few in number but conspicuously different in land form and soil, the latter being, in almost every case, a dark greenish yellow loam five or six inches thick, known technically as the Paxton Loam, which is outstanding in its capacity to hold moisture during periods of drought.⁴² To complete the concept of these sites, the position of the area across the narrow east coast extension of the Dfa climate must be kept in mind.

The combinations of cover are: (1) urban; (2) rural hamlets or villages; (3) cleared farmland, including small patches of woodland but being chiefly utilized for hay and pasture or fruit and truck farming; (4) woodland, including small clearings of farmland; and (5) a few large estates with extensive lawns and gardens, neat, well kept buildings, and herds of superior cattle. Of the possible twenty combinations with the sites, sixteen actually occur. The most significant of these landscape formations are: (1) urban areas in the valley bottom and the neighboring intermediate slopes; (2) the cleared farmland on the upland and the gentler intermediate slopes; (3) woodland on the steeper intermediate slopes, especially along the steep sides of the main valley of the Blackstone; (4) rural hamlets on the upland. Tables 1, 2, and 3 show the areas occupied by each of the formations, and present a statistical analysis of the relationships between site and culture.

TABLE 1
AREAS OCCUPIED BY THE SEVERAL LANDSCAPE FORMATIONS
(In square miles)

	Valley	Slopes	Upland	Drumlin	Cover Totals
Urban	9.1	13.5	.5	.1	23.2 (13%)
Cleared Farmland	7.4	49.1	18.4	.8	75.7 (42.3%)
Woodland	2.1	70.5	6.3	.2	79.06 (44.1%)
Rural Villages1	.5		.62 (.3%)
Estates1	.1		.11 (.2%)
Site totals	18.6 (10.4%)	133.3 (74.7%)	25.8 (14.4%)	1.1 (.5%)	178.8

⁴¹W. J. Latimer, R. F. R. Martin, and M. O. Lanphear, *Soil Survey of Worcester County, Massachusetts*. U. S. Dept of Agric., 1927, p. 1572.

⁴²Ibid. p. 1566.

TABLE 2
PERCENTAGES OF THE SITES OCCUPIED BY THE DIFFERENT COVERS

	Urban	Cleared Farmland	Woodland	Rural Villages	Estates
Valley	49.2	39.7	11.1	0	0
Slopes	10.1	37.0	52.8	.1	0
Upland	1.8	71.8	24.6	1.8	0
Drumlins	5.0	76.0	19.0	0	0

TABLE 3
PERCENTAGES OF COVERS IN THE DIFFERENT SITES

	Valley	Slopes	Upland	Drumlins
Urban	39.4	58.2	2.1	.2
Cleared Farmland	9.7	65.0	24.4	1.0
Woodland	2.8	89.0	7.9	2
Rural Villages	0	24.2	75.8	0
Estates	0	54.5	45.5	0

These tables show quantitatively the existence of certain expectable areal relationships. The valley bottom, for example, has about 50 per cent of its area in cities. The greater part of the intermediate slopes with their thin, stony soils are in woodland, while 71 per cent of the upland is cleared farmland. Analyzing from the point of view of the covers, only about 40 per cent of the urban areas are in the valley. This being too narrow to contain the expanding cities, 58 per cent of the urban area has spread onto the adjoining intermediate slopes; but only 2 per cent is on the upland, separated as it is from the lines of communication essential for urban existence. It is important to note that only about a quarter of the cleared farmlands is on the upland, a large percentage lying on the poorer slopes; and that of the wooded areas, almost 90 per cent occupy the slopes. The actual distribution of these landscapes is shown in figure 4.

The mapping of such landscape formations in an area can be accomplished by a reconnaissance; but before such a generalization becomes of scientific value some closer inspection of the character of the units is necessary. In this study, ten representative areas were chosen for detailed study and were surveyed on a scale of 1:10560. These topographic⁴³ studies are intended to illustrate the character of the landscapes in detail, and are themselves

⁴³Topography is used in this paper in the original sense used by the U. S. Geological Survey and given in the dictionary: the detailed description of a particular place, not only as regards its surface forms, but also the other forms of its landscape. Topography, then, is in a series with chorography, the description of a larger area or region, and geography, the description of the earth or a major part of it.

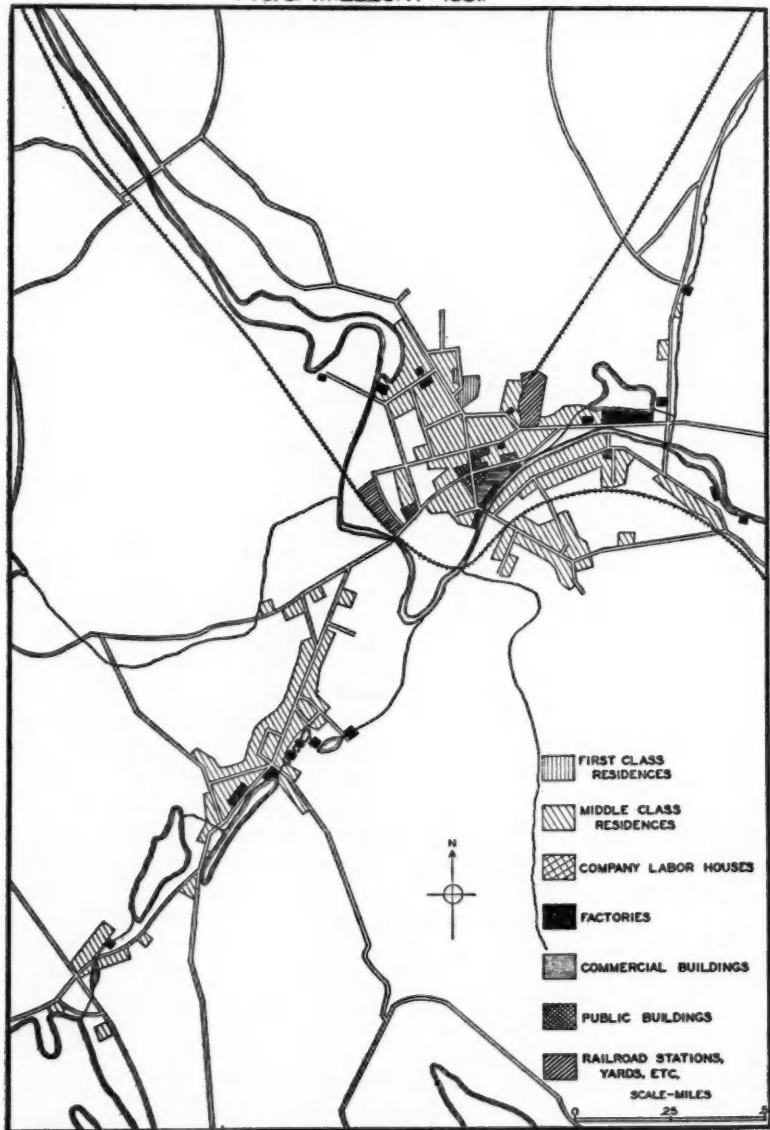
subject to statistical analysis so that the description can be made quantitative. Only in this way can landscapes be described accurately so that later on, after more detailed information has been gathered, the beginnings of scientific landscape classification can be made. The first of the following topographic studies deals with the town of Millbury; the other nine studies each cover a square mile of area so placed as either to exhibit a typical expression of a formation, or to illustrate the character of a boundary between different formations.

Millbury, An Urban Study (Fig.7)—Millbury, like many of the other towns along the Blackstone, occupies a narrow section of the valley. Within or immediately contiguous to the city area the relief of the surface is about four hundred feet. The Blackstone itself, at this town, descends rapidly over the resistant outcrops of Brimfield Schist; and at its conspicuous eastward bend within the city, it is joined by Singletary Brook draining from the upland. Singletary Brook is remarkable as a power resource in that its flow is maintained by the lake which it drains—now dammed to furnish additional uniformity of flow,—and in that it falls 212 feet in a distance of about 1.25 miles. The immediate valley sides, both of the valley and its tributary, are steep and rocky and thus poorly adapted to agricultural or pastoral use.

In a country where water power is utilized, such a site inevitably came into prominence. The first industry to be established here was a grist mill, located on Singletary Stream within fifty feet of the outlet of Singletary Pond.⁴⁴ At this advantageous location the upland agricultural area around Sutton was served without the necessity of descending and ascending the steep slopes to and from the main stream. Shortly after the grist mill was built, the demand for construction timber in the growing community called for a lumber mill, and in order to provide water for this, Singletary Pond was dammed. Both these mills were built and running in 1720. During the eighteenth century a number of other mills were built along Singletary Brook, and a few along the main stream. The variety of industries operating in 1792 has already been mentioned, these including iron foundries, rolling mills tool manufacturing plants, powder mills, and others. The first textile establishment was started in 1828 in an old building refitted for the manufacture of cotton batting.

⁴⁴*Centennial History of the Town of Millbury.* Op. Cit., p. 240.

FIG. 5. MILLBURY 1851.



The detailed record of the building and changing fortunes of the various manufacturing plants of Millbury contained in the Centennial History⁴⁵ is striking in three respects. In the first place each building is used in the course of its existence for many different kinds of production. Again and again there are records of renovations, or of refittings, in many cases with radically different kinds of manufacturing following each other. One building, for example, was utilized as a linseed oil mill, as a paper plant, as a machine shop, for the manufacture of fancy cassimeres, and finally for the manufacture of woollens. The second striking feature is the repeated burning of mills, losses due to fire appearing in the records of almost every mill site in the town. In some cases, burned mills were speedily replaced, but in many others the old site was abandoned and the faint trace of a foundation, overgrown with bushes, is all that remains. The third point is that after the opening years of the present century, there has been almost no additional construction. Mills are shut down or abandoned, but growth is conspicuously lacking. The maps (Figs. 5, 6, and 7) show the areal extent of Millbury in 1851,⁴⁶ the additions between that date and 1886, and those added since that date. The town had reached essentially its present development in 1851, lacking chiefly the narrow connection of residences between the Singletary Brook section and the main urban center in the valley of the Blackstone. Additions since 1886, chiefly residential, are minor. Millbury is a city of past achievements, a cradle of inventions which have influenced other mills and other cities wherever manufacturing is carried on; but today its period of youth and growth is over. It has no real estate subdivisions on its periphery. It has no group of citizens to tell of its future. The signs along the highway to welcome the passing motorist are broken and rusted. It reeks of that atmosphere which one finds in a small New England manufacturing town, and which tells of a struggle not to move forward but to keep from decline.

The internal structure of Millbury is similar to other towns along the Blackstone (Fig. 7). Its commercial center is located in the valley bottom near the junction of the side valleys where roads join or cross. The mills are found along the streams near the water power sites which gave them birth, and are scattered through the town from one end to the other like beads on a string.

⁴⁵Ibid. pp. 240-289.

⁴⁶From a Map of Millbury and Vicinity in 1851, by Walling and Harkness.

FIG. 6. MILLBURY 1886.

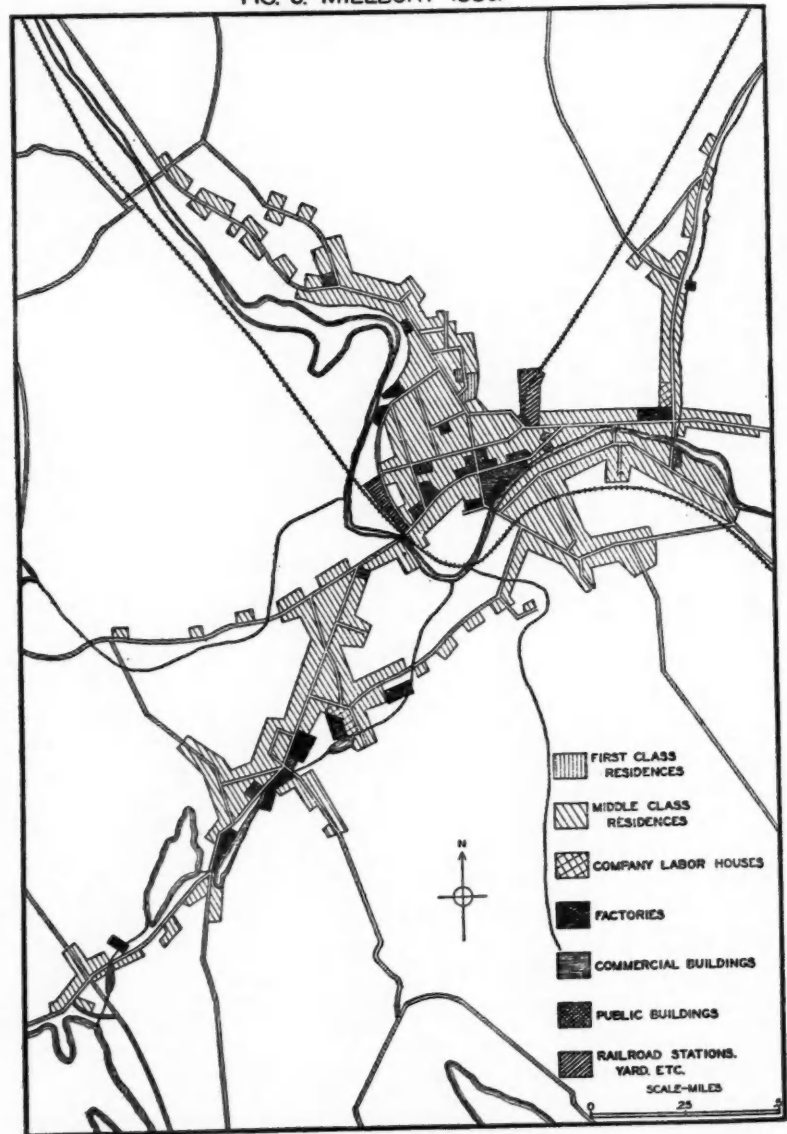
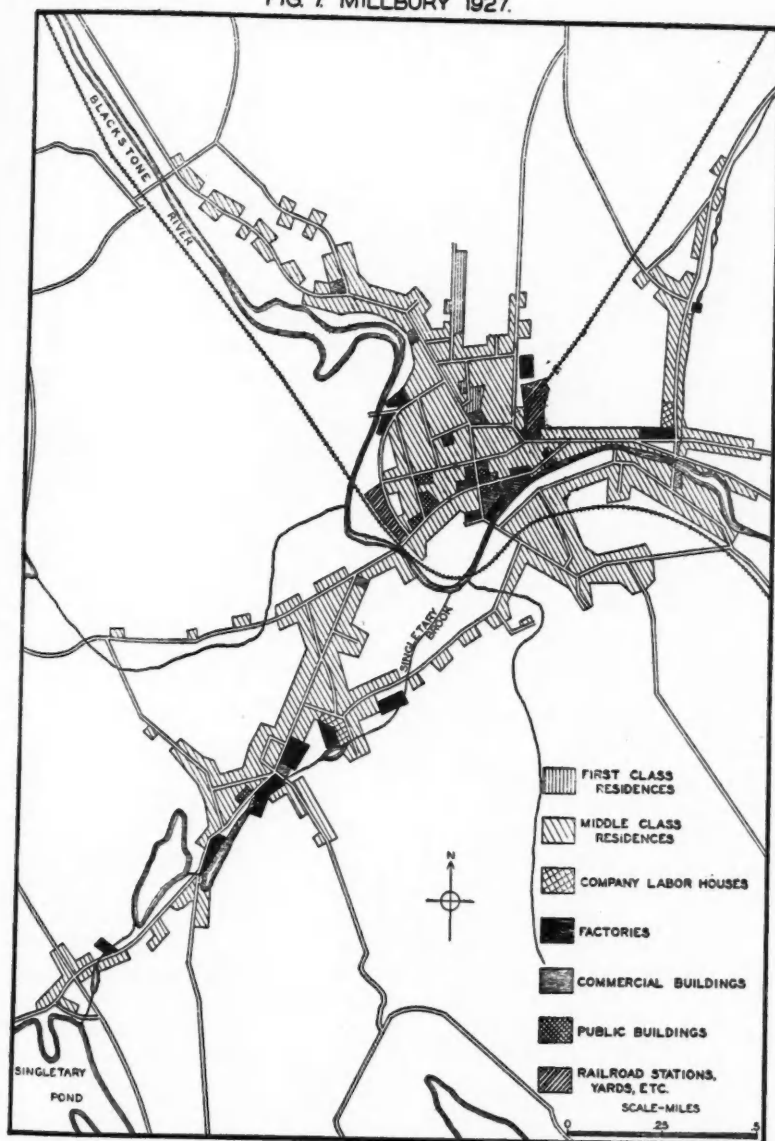


FIG. 7. MILLBURY 1927.



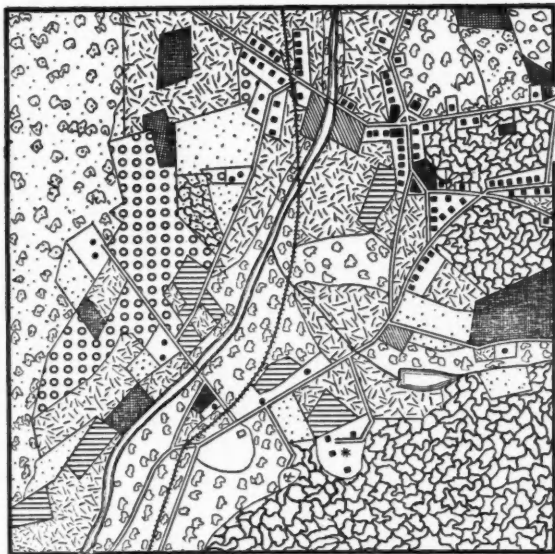
The residences, especially the better class ones, prefer a location on the sides of the valley where these sides are not too steep. The outline of the town, however, strings out along the valley, altogether unlike the outline of towns on plains.

Wilkinsonville.—The little community of Wilkinsonville, just below Millbury along the main valley (Fig. 8),⁴⁷ may be taken as an example of the several one-factory towns. The group of mill buildings is along the river, while the residence area is on one of the terraces of the valley bottom, never having reached sufficient size to climb far onto the steeper slopes. The rudimentary commercial center is found at the cross roads along the main highway. At the present time, after a period of feverish activity during the war, the mills in this town are closed and the few families still living in its residential area seek work elsewhere.

The Urban Margins: Worcester South of Pakachoag Hill.—The definition of the urban as opposed to the rural landscapes cannot, as yet, be stated in quantitative terms, although further study will no doubt make such a statement possible. The boundaries in this study are drawn on the basis of the qualitative combination of a number of criteria. House architecture is the most conspicuous feature; but since expanding city margins often include many converted farm houses, this form alone cannot be used without other checks. The occupation of the families using the houses is a criterion of importance; although in the Blackstone area this led to some confusion as many of the persons living in the country on farms sought work at certain seasons of the year in the towns, and usually, when this was the case, derived a large part if not the larger part of the family income in so doing. Another criterion may be found in the arrangement of the houses. Closely set homes, with small lots utilized for vegetable gardens or for hen yards are obviously urban; while isolated farm houses, with barns, sheds, and other outbuildings, and surrounded by extensive fields are typically rural. Other criteria include the road pattern, the presence of street lights, and public utilities such as gas, water, sewers, etc. Then, too, the intent in ownership is in some cases critical, since it seems desirable to include platted real estate subdivisions where roads and other improvements have been already made, in the urban formation. It should be noted that only rarely

⁴⁷Figures 7 to 16 were surveyed in the field during the summer of 1927. The location of these representative areas is shown on Figure 1.

FIG. 8 WILKINSONVILLE AND VICINITY



*STATE FISH HATCHERY

KEY FOR TOPOGRAPHIC STUDIES
FIGURES 8 THROUGH 16

FOR LOCATIONS SEE FIGURE 1 AREA IN EACH CASE ONE SQUARE MILE. CONVENTIONALLY ORIENTED WITH NORTH AT TOP OF PAGE.

	CORN		WOODLAND PASTURE
	HAY AND CLOVER		WOODLAND
	VEGETABLES		SCRUB AND CUT-OVER BRUSHLAND
	APPLES, PEACHES, VINEYARDS		CHURCH
	CLEARED PASTURE, INCLUDING PASTURE WITH SMALL BUSHES		STORE
	BRUSH PASTURE		COUNTRY ESTATE
			FARM BUILDINGS
			URBAN RESIDENCE OR BLDG.
			GRAVEL PIT

AREAS LEFT BLANK ARE THE YARDS OF URBAN HOMES, FARM YARDS, LAWNS, ETC.

is the political boundary of a city of any value as a geographic criterion.

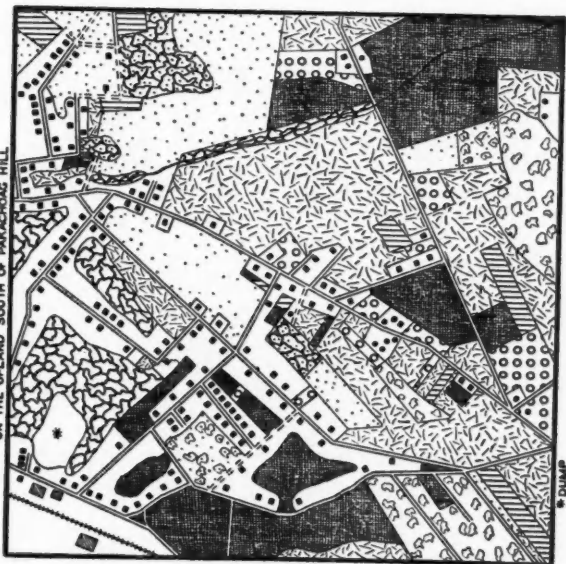
In the Blackstone area the boundary between urban and rural landscapes is in most places fairly sharp and easily identified. Isolated urban houses are, it is true, found outside of the main body of the city; and in some cases farms are still found within the geographical city limits. A static city, such as most of the smaller ones in the Blackstone, generally has sharply defined limits; whereas an expanding city merges with the surrounding rural areas through a broad transition zone of relict farms within the city, and isolated suburban homes or platted subdivisions scattered through the country. Worcester has expanded in recent years into the cleared farmland on the upland south of Pakachoag Hill (Fig. 9). In this section modern suburban homes of flimsy construction, closely packed together, rub elbows with a few scattered farm houses now converted to urban uses, or maintained as farms in spite of the encroachment of the city. Of the latter there are few, for the value of such land in a growing residence section makes profitable farming impossible. Since the soil is a mellow loam in this area, much of the peripheral farm lands are used for growing vegetables, with years of rotation in which they are planted to hay or clover. A large greenhouse and a creamery along the main road face growing ranks of urban homes. Farther back in the area occupied by the city, former pastures or farms not yet built up appear as idle brush land. However, small vegetable patches and orchards in the back yards of the urban homes tell of the attraction of the rural activities when they can be enjoyed on a modest scale.

Woonsocket and Manville, Rhode Island.—Woonsocket, too, is expanding; but, at least in a southerly direction, its expansion is not as vigorous as that of Worcester. Manville, located just below Woonsocket, has struggled up the sides of the narrow valley (Fig. 10) both to the northeast and the southwest, but chiefly in the former direction. The suburbs of Woonsocket have already reached out and, on paper, have joined the northeastern edge of Manville. However, although the slope of the valley has been marked off into roads and house lots, little construction has yet taken place. The few homes which mark the outposts of the city are still reached by rudimentary streets with pretentious names, but have not yet been connected with sewers and gas. In the idle land beyond, irregular patches of vegetables are found, perhaps

FIG 10 MANVILLE AND THE SOUTHERN MARGIN OF
WOONSOCKET



FIG 9 OUTSKIRTS OF WORCESTER
ON THE UPLAND SOUTH OF PIMACHOG HILL



cultivated by squatters. The soil of this section is stony and infertile, so that truck farming on a large scale is lacking. The farm land is in hay or pasture, while the steeper slopes and the marshy area along the small brook are left in scrubby timber.

The Cleared Farmlands: Sutton.—The expression of the cleared farmland varies with different conditions of site. On the upland, and especially in areas of loam soil, the cleared farmland appears somewhat as illustrated by the country north of Sutton (Fig 11). In order to present the description of this landscape quantitatively the following statistical analysis is used (Table 4). In the interpretation of these figures it is necessary to keep in mind that they do not represent simply the land use in an area of varied natural conditions. They measure, rather, the relative areal importance of the cover of an essentially uniform site. Because of the uniformity of the basic physical conditions, this analysis may be taken as the quantitative definition of a landscape formation.

The analysis shows that in the square mile which was studied, fields of hay and cleared pastures make up almost half of the area, while about a quarter is covered with woods and brush.

TABLE 4

UPLAND NEAR SUTTON

Cleared farmland and rural hamlet, on upland and drumlin. Soil: chiefly loam.

Hay	35.1%	
Cleared Pasture.....	10.8	
Brush Pasture.....	7.0	
Woodland Pasture.....	10.4	
Scrub and Brush Land.....	6.0	
Woodland	4.0	All pasture, 28.2%
Corn	4.4	All woodland and brushland, 27.4%
Truck Crops.....	1.0	
Orchards	3.2	
Farmsteads—Village land.....	8.0	
Water	3.0	
	100.9	

New England farmland shows a close adjustment to surface and soil, not only in general, but also in detail.⁴⁸ The 27 per cent of wood and brush land in the Sutton area is found almost exclusively in the small valley where the side slopes are steeper and

⁴⁸I. G. Davis, and C. I. Hendrickson, *Soil Type as a Factor in Farm Economy, The Town of Lebanon*. Bull. 139, Agricultural Experiment Station, Storrs, Connecticut, 1926.

FIG. 12 BRIGHAM HILL
CLEARED FARMLAND ON INTERMEDIATE SLOPES



FIG. 11 SUTTON AND VICINITY
CLEARED FARMLAND ON THE UPLAND



stonier, and where the bottom is marshy. The hay fields and pastures are marked off as previously described into small units by the inherited stone walls, and along these walls there is such a thick growth of bushes and trees that one gains the impression of a larger amount of wooded land than actually exists. Small patches of corn, truck crops, and fruit orchards are scattered throughout the area. The village of Sutton itself is located at the intersection of two highways. The road leading in from the north-west was formerly one of the chief traveled highways of this part of the country, following approximately the line of the old Indian trail, and not until railroads found an easier westward path by making deep cuts through intervening ridges did this road definitely lose its importance. At the present time, unlike the other roads on the upland, this road is paved, thus giving the village of Sutton and the dairy and other farm products which originate in the neighborhood, an excellent connection with the valley markets through Millbury.

Brigham Hill.—The cleared farm landscape reaches the expression found in the neighborhood of Sutton only in areas of the better loam soils. Elsewhere, on the gentler intermediate slopes, in areas of sandy, gravelly, or stony soils, the amount of land devoted to pasture increases at the expense of hay. Brigham Hill may serve as one example of this formation (Fig. 12), a statistical analysis being presented in Table 5.

TABLE 5

HILLY COUNTRY AROUND BRIGHAM HILL

Cleared farmland with country estates, on intermediate slopes. Soil: stony fine sandy loams, chiefly Gloucester.

Hay	16.3%	
Cleared Pasture.....	26.6	
Brush Pasture.....	19.8	
Woodland Pasture.....	12.7	
Scrub and Brush Land.....	3.8	
Woodland	6.6	All pasture, 59.1%
Corn	4.3	All woodland and brushland, 42.9%
Truck Crops.....	3.6	
Orchards	0.8	
Estate Grounds and Buildings..	2.5	
	97.0	

In this square mile, pasture—cleared, brush, and woodland—make up about 60 per cent of the area. A little less than half is

covered by woods or brush, most of the woodland being also pastured. The cultivated fields show a marked tendency to border the roads, leaving the area farther back in pasture, although this land may be physically as well suited to cultivation as the more accessible fields. A number of large estates appear in this study,—beautiful houses surrounded by well kept lawns, and utilizing the surrounding pasture lands for high breed dairy cattle or horses.

Brigham Hill Farm itself, the second estate on the road entering figure 12 in the northwest corner, has had an interesting and somewhat typical history. The oldest part of the present building was started in 1728, and took five years to complete. Timber from the farm itself was used, and the rocks which were dug out of the fields were used for the foundations and for the large stone walls. For approximately a century the farm was profitable, but about 1825 its rocky soils began keenly to feel the competition of better areas in the immediate neighborhood. The farm was handed down in the Brigham family, being gradually divided into smaller and smaller units. The present owner, having retired from business, now lives on the original farm which does no more than pay for its upkeep. On the three hundred acres which remain, the owner, using hired labor, raises about eighty tons of hay a year, sells small amounts of cabbage and sweet corn in the Worcester markets, where he also sends the milk from his herd of dairy cattle. While the buildings still perform in a certain way a farm function, they are more properly classified as belonging to a country estate, since without the support of money earned elsewhere they would no longer be kept in repair or perhaps even in use. In almost every case, large, prosperous looking farms in rural New England are found to be maintained in this way.

The Farmland North of Pawtucket.—The remnants of the New England peneplain become fewer and of less extent as one goes southward into Rhode Island. Similarly, the loam soils of the upland are encountered less frequently. Although no soil survey is available for the Rhode Island section, observation leads us to the belief that the soils are distinctly stonier and less fertile than the soils farther north. The cleared farmland of this part of our area should, then, exhibit the expression typical of these smoother intermediate slopes with stony soils, such as was illustrated by the Brigham Hill study. In the square mile surveyed a little north of the outskirts of Pawtucket (Fig. 13), the statistical analysis (Table 6) shows the expected resemblance.

FIG. 14 UPLAND AND SLOPES SOUTH OF GRAFTON

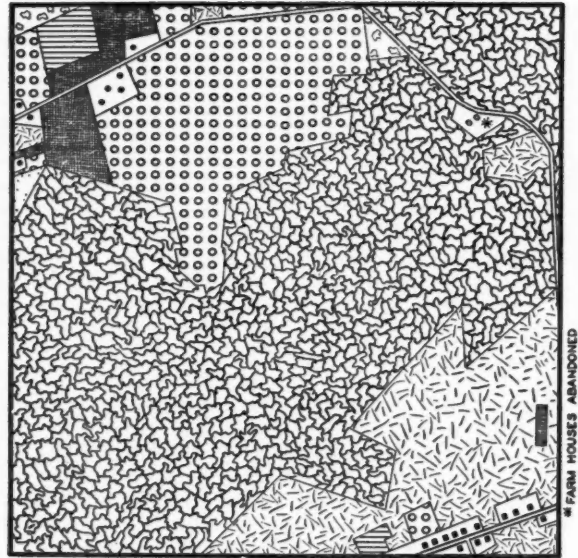
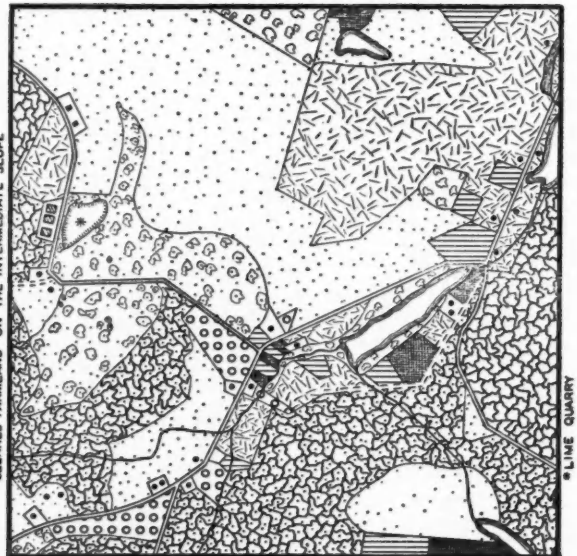
FIG. 13 INTERMEDIATE SLOPE NORTH OF FAWTUCKET
CLEARED FARMLAND ON THE INTERMEDIATE SLOPE

TABLE 6
 HILLY COUNTRY NORTH OF PAWTUCKET

Cleared Farmland, on intermediate slopes. Soil: stony and gravelly, sandy loams.

Hay	21.6%	
Cleared Pasture.....	29.9	
Brush Pasture.....	10.4	
Woodland Pasture.....	19.4	
Scrub and Brush Land.....	0.9	
Woodland	5.7	All pasture, 59.7%
Corn	2.3	All woodland and brushland, 36.4%
Truck Crops.....	1.6	
Orchards	2.4	
Farmsteads	3.1	
Water	1.9	
<hr/>		
98.8		

Pasture, by a significant coincidence, occupies the same percentage of the area; and the amount of land left in woods or brush is comparable. The small amount of agriculture, in spite of the proximity of a large city, reflects the poverty of the soil, and forms an interesting contrast with the loam soil upland south of Pakachoag Hill, where soils are relatively fertile. The cultivated fields, as common to this landscape formation, show a marked tendency to border the roads.

If we may apply these topographic studies to the formations shown on figure 4, we may say that about 65 per cent of the cleared farmland occurs on the intermediate slopes, and therefore has an aspect similar to that described for Brigham Hill and the outskirts of Pawtucket (see table 3); whereas only about a quarter is of the type illustrated by the Sutton study. However, the cleared farmland has a third expression which is of growing importance, and which reflects the influence of the urban landscape most vividly. This is the large scale fruit and truck farming, located for the most part on the upland.

The Fruit and Truck Farming Expression: Fisk Farms.—

Along the hill top south of Grafton a large scale fruit and truck farm enterprise has been started (Fig. 14). The exposure and air drainage as well as the loam soil, are favorable for the growth of apples, pears, and peaches. The Fisk Brothers, owners of the farms, are fruit and vegetable wholesalers in Providence, to which city the products of these farms are sent by motor truck. On the five hundred acres near Grafton, a part of which appears in our topographic study, most of the land is devoted to apples, with

smaller amounts planted with pears and peaches, and with still smaller fields of cabbages, sweet corn, tomatoes, celery, beans, and other truck crops. At the present time new land is being cleared of woods and brush and planted with apples. At its westernmost extent, the orchard area has reached the end of the upland and of the area of loam (Figs. 1 and 2), and further expansion in that direction will be stopped by the steep slopes and thin, stony soils below. Expansion southward along the ridge top, however, will be relatively easy. The Fisk Farm employs a regular force of 17 men, and during harvest time drafts the services of between 70 and 90. Judging from the upkeep of the buildings and the lands alone the business is a profitable one, and of a type which is rapidly spreading in rural New England. The same company operates another similar fruit farm on the upland a little east of Sutton. In every case where large scale orcharding is proving successful, the trees are set out on hill tops or upper slopes, as, for example, the orchards on the drumlin northwest of Wilkinsonville (Fig. 8). Apparently a marketing organization,—in the case of the Fisk Brothers, concentrated in the hands of one company in a large city,—is all that is needed to make at least a small part of the New England farm lands again productive. However, judging from other areas, some prediction can be made regarding the development of this truck farming and orcharding expression. At the present time, it occupies almost exclusively those areas best suited to orchard culture, under which conditions it may be considered as in a first stage of adjustment. As the possibilities of deriving profits from such an industry become apparent, more and more land will be devoted to orchards and truck farms, but in this expansion land not so well suited to such uses will be occupied. This may be considered as a second stage. Later, the lands which are unsuitable because of poor soil, liability to early and late frosts, difficult accessibility, or other reasons, will be abandoned, and this expression will become more permanently adjusted to the better areas, but with more intensive methods of cultivation than are practised at present. This may be thought of as a third stage.⁴⁰ The individual disaster and suffering which is brought about by a too rapid or too wide expansion is one of the unfortunate aspects of this progress from the second to the third stage.

⁴⁰P. E. James, A Geographic Reconnaissance of Trinidad, *Econ. Geog.*, Vol. 3, 1927, p. 108.

The Woodland Landscapes: A Study of West Whitinsville.—Areally speaking, the two most important types of cover, cleared farmland and woodland, are about equally divided (table 1). As we have already pointed out, much of the present woodland was once cleared and cultivated. The woods at the present time are found to a marked extent occupying the steeper and stonier lands, nearly 90 per cent being located on the rougher intermediate slopes (table 3).

The woodland landscape on these stony slopes may be illustrated by a square mile lying on the intermediate slopes west of Whitinsville, an area of thin, gravelly soil alternating with marshy stretches along the narrow brook bottoms (Fig. 15). The statistics for this landscape stand in interesting contrast to those of the cleared farmlands (table 7). In the first place 78 per cent is ungrazed woodland, and only about 12 per cent is cleared. Crops and pasture, therefore, form only small percentages of the whole. The trees are mostly hardwoods, generally too small in this area for use as timber. However, much of the woodlands has been thinned for firewood, and piles of logs are found at many places along the roads.

TABLE 7

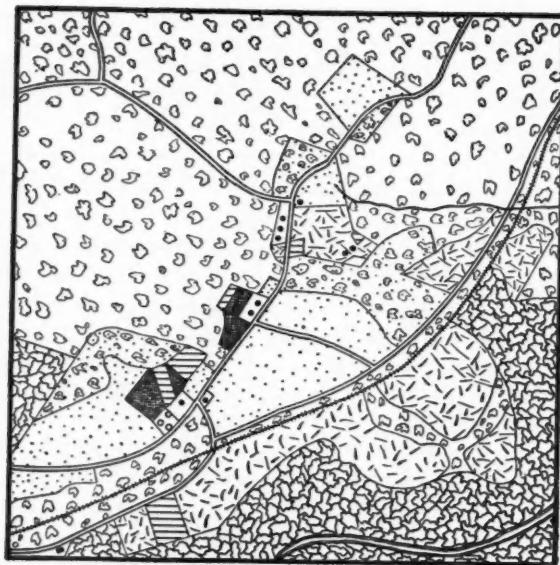
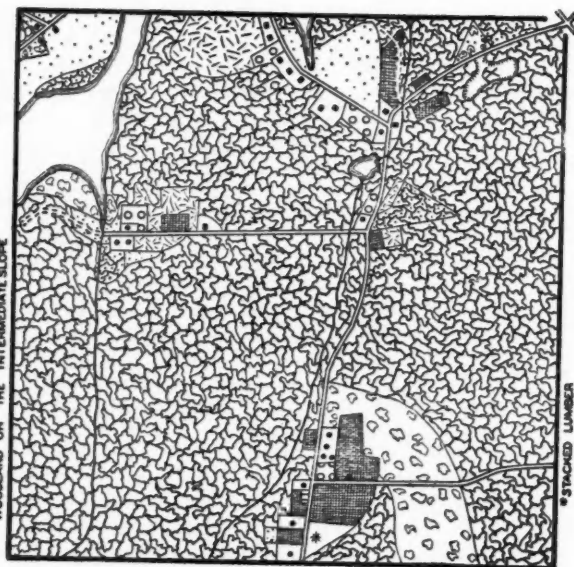
HILLY COUNTRY WEST OF WHITINSVILLE

Woodland, on intermediate slopes. Soil: stony, sandy, and gravelly loams, with narrow belts of meadow.

Hay	2.5%	
Cleared Pasture.....	4.0	
Brush Pasture.....	0.4	
Woodland Pasture.....	1.5	
Scrub and Brush Land.....	5.2	
Woodland	78.1	
Corn	Cleared land, 11.6%
Truck Crops.....	2.4	
Orchards	0.7	
Farmsteads	2.0	
Water	3.0	
	99.8	

Small areas are found where the whole forest has been recently removed, leaving only a waste brush land, not even suitable for grazing, as in the semi-circular belt near the southwest corner of figure 15. The old sawdust piles in such areas of brush, even after the cords of firewood have been removed, reveal the earlier presence of at least a scrub forest. Apparently it takes only a few

FIG. 18 THE VALLEY SOUTH OF UXBRIDGE

FIG. 15 INTERMEDIATE SLOPE WEST OF WHITINSVILLE
WOODLAND ON THE INTERMEDIATE SLOPE

years, about 20 or 25 at the most, for brushlands or abandoned farmlands to grow up with dense stands of poor timber.

The clearings which are found within the woodland landscape are miniatures of the larger body of cleared farmland outside. So common is this inclusion of small detached pieces of a larger landscape formation within the body of a neighboring formation that the term *ectochore* is proposed for them. In the area of this study, the ectochore lying just west of Burt's Pond (the body of water near the northeastern corner) has had an interesting and typical history. The farm in this clearing was built in 1786, requiring several years for its construction from local timber. It was on this land that the irrigation system described earlier was built to increase the yields of grain. A large herd of dairy cattle was kept on the extensive cleared pastures, and the farm was reputed to be among the most prosperous in the neighborhood. With the gradual decline in agricultural prosperity, however, the farm was gradually abandoned, and finally stopped production in 1880. The present owner points out areas now densely forested which in those days were used for pasture. After living for a time in the city, he returned to the farm in 1919, clearing off some of the growth of brush by using sheep. At the present time, the owner works in the shops at Whitinsville nearby, raising on his small farm about 10 tons of hay, and keeping two cows, a horse, and some poultry. Here again, it is found that the major part of the family's income is derived from work in the city—a condition which is probably widespread in this part of rural New England.

The boundary between the cleared farmland and the woodland formations is, in most cases, sharply defined and easily recognized. This is illustrated by a study along the valley a little south of Uxbridge (Fig. 16). Here the cleared farmland, chiefly hay and pasture, is clearly set off from the brushland. At one time there was an ectochore of farmland along the road which extends toward the northeast corner of the map, but this having been abandoned, and the house having burned down, is today scarcely distinguishable. Recently the woods were cut, so that the bulk of the area is waste brushland, covering a thin, stony soil.

CONCLUSION

Thus the landscapes of the Blackstone area are made up of a complex of cultural impressions set one upon the other. The three chief cultures, the native Indian, the rural European, and the urban manufacturing, have each modified the natural setting in a unique and characteristic way. Forms developed by the Indian culture are visible even today in the shell mounds, the deposits of chipped stones and broken utensils, or the scarcely discernible trails. The forms of the rural European culture are visible on every side, some of them continuing without change of function to the present, others significantly modified in their use, and others remaining as weather beaten ruins or brush entangled fields to tell of a period which exists no more. In the course of time, however, the cleared farmland landscape has developed different expressions in different situations. Only the graded uplands with their loam soils exhibit the characteristics of the area around Sutton. On the stonier intermediate slopes, many of the cleared fields are no longer planted to crops, but are used instead for pasture, and in many cases are growing up with brush. Where the surface is very rough and the soil thin, the complete abandonment of the land for either crops or grazing is common, and a scrubby woodland, thinned for firewood, now dominates the landscape. In a few places, an entirely new expression of the cleared farmlands is appearing under the influence of the city markets, namely, the large scale orchard or truck farm. Finally, the urban landscape, in spite of its relatively small area, has come to occupy the position of commanding importance around which the economy of the region is oriented. Yet change still continues. The urban landscape, too, reached a zenith of growth and prosperity, and is now gradually shrinking in the smaller, less effectively located units, and concentrating in the better and larger units, where production is maintained by a more intense and efficient activity.

It seems probable that the present tendency to concentrate in the larger cities will continue for some time, leading perhaps eventually to the complete loss of urban function by the smaller single-mill towns. With the concentration of the people in cities, especially as those cities are located in the midst of a hilly land with poor soils, the railroad connections with other parts of the country and with the sea ports, and the paved highways must continue to grow in importance, for over these must pass not only the exported manufactured products, but also the imported raw

materials and foodstuffs. The large scale orcharding which is now beginning is due for a rapid over-development, followed later by a decline of the poorly located farms, and a concentration of such activity in the better areas. The cleared farmland expression found near Sutton will be modified no doubt by an increase of area in fruit and truck. In another half century, abandoned orchards will be listed with abandoned crop and pasture land on the poorer areas as a relict form. Eventually the definite use of such lands for timber production and recreation may come to be widespread.

